TABLE 4A. Summary of 1994-2000 Findings on County Stream Resource Conditions

Stream Resource Condition	Stream Miles	Stream Miles Monitored (%)	Watershed (acres)	County Acreage Monitored (%)
Excellent	84	7	18,091	6
Good	695	55	143,512	50
Fair	362	28	86,431	30
Poor	131	10	41,580	14
Total Monitored Miles	**1,272**	**100**	**289,614**	**100**
Intermittent streams or streams too deep to monitor	112			
River/lake/canal systems monitored by other agencies	114			
Total County Stream miles	**1,498**		**291,001**	

watershed is in good condition, with only relatively small areas in the northwest supporting fair stream conditions (Figure 4B). Horsepen Branch contains the poor and fair drainage areas south of Dry Seneca Creek (Figure 4B) and enters the Potomac River within the McKee-Beshers Wildlife Management Area (CSPS, 1998). Wetlands in the lower Horsepen Branch have been designated as wetlands of special state concern because of their botanical diversity and value to wildlife (CSPS, 1998). Much of the watershed tends to dry up almost completely in the summer due to the drought sensitive underlying geology and only supports a poor or fair stream condition (Figure 4B). However, the upper portions support good stream conditions (Figure 4B).

Dry Seneca Creek (Good) is a large tributary to Seneca creek, draining Poolesville and portions of Beallsville. Conditions throughout much of the watershed are good, however the stream in the upper portion of the Peach Tree Tributary and the more urbanized Russell Branch are poor. Conditions in other areas of Poolesville and the Darnall Tributary are fair (Figure 4B). Monitoring data collected after 2000 found poor stream conditions below the Poolesville Wastewater Treatment Plant (WWTP) and the more urbanized Russell Branch. DEP's monitoring indicated that overloaded conditions at the Poolesville WWTP were a direct cause of some of the poor water quality and biological conditions observed in the Dry Seneca Creek. DEP has been working closely with Poolesville and the Maryland Department of the Environment (MDE) to ensure that the WWTP and sewer line upgrades are pursued expeditiously to rectify these problems.

Hawlings River (Good) is a major tributary of the Patuxent and plays an important role in the overall efforts to reduce *nutrient* and *sediment loadings* to this river, and in particular, to the Rocky Gorge reservoir, a public drinking water supply (CSPS, 1998). Overall, the Hawlings continues to support a good stream condition. Portions of the Reddy Branch and James Creek, draining the Olney developed area, support either poor or fair stream conditions. The upper reaches of the Gregg Tributary and a small portion of the Hawlings in the northwest are also in fair condition (Figure 4B).

Little Monocacy (Good) is one of the most scenic rural watersheds in the county (CSPS, 1998). It supports habitat and water quality parameters supporting good stream conditions throughout the watershed (Figure 4B). The headwaters draining a portion of Sugarloaf Mountain support excellent stream conditions.

Little Seneca Creek (Good) drains Clarksburg, Germantown, and Boyds before flowing into Great Seneca Creek near Dawsonville (CSPS, 1998). Land use within the watershed is very diverse, ranging from agricultural to urban. Stream conditions within the watershed reflect the diversity of landscapes. Stream conditions range from a small poor drainage area near Lake Churchill to excellent stream conditions in much of the Ten Mile Creek area (Figure 4B).The Little Seneca Creek drainage, above Little Seneca Lake, contains the Clarksburg Special Protection Area. This rapidly changing area will have long lasting effects to the quality of the stream.

Upper Great Seneca Creek (Good) begins in the vicinity of Hawkins Creamery Road and contain the headwaters of the Great Seneca Creek watershed (CSPS, 1998). This watershed supports many areas of excellent to good stream conditions (Figure 4B). The only area found supporting poor stream conditions is a small headwater drainage area of Magruder Branch (Figure 4B). This area receives stormwater runoff from the highly impervious Damascus commercial area in the vicinity of Bethesda Church Road.

Upper Patuxent River (Good) forms the boundary between Montgomery and Howard County and includes all the land draining to the Patuxent River above the Triadelphia Reservoir (CSPS, 1998). The watershed includes large forested areas along with agricultural cropland, pasture and large lot residential development (CSPS, 1998). Much of this watershed supports good stream conditions as well as many areas supporting excellent stream conditions (Figure 4B). As in Little Bennett, many of the best streams remaining in the county are also found within this watershed. Only one small stream supported fair stream conditions in this watershed (Figure 4B). This stream, called Mt. Carmel Tributary in the 1998 CSPS, parallels Georgia Avenue. Road impacts may be affecting the stream.

Upper Rock Creek (Fair) contains the headwaters of the first major Potomac tributary west of the Anacostia River drainage (CSPS, 1998). Today, homes and businesses have almost entirely replaced farms and fields as the landscape has been changed as a result of planned growth. This watershed supports a wide range of stream conditions ranging from excellent to poor (Figure 4B). Areas with poor stream conditions are adjacent to areas with excellent stream conditions reflecting the changes occurring in this watershed (Figure 4B).

V. Habitat Status

Average habitat conditions by major watersheds

Figure 5A presents habitat ratings for all stations monitored between 1994 and 2000. Table 5A presents this information converting station data to stream miles and watershed acreage. Most of the stream miles monitored (seventy eight per-cent) had ratings ranging from "excellent" to "good" while fifteen percent of the stream miles rated from "good/fair" to "fair/poor." No stations scored "poor" (Figure 5A). Ratings for ten of the stations shown on Figure 5A were based on data from 2001 and 2002 due to lack of earlier data.

The majority of the "excellent" and "excel-lent/good" stations were located in the northern part of the county. Forested areas, publicly-owned parkland, and older residential areas supported "good" stream habitats. Almost all "fair" habitat areas were within the down-county developed part of the county. "Fair" habitat areas were located throughout the Lower Rock Creek watershed: in the Bel Pre Tributary portions of the Northwest Branch watershed, the North Branch portions of the Upper Rock Creek watershed, Lower Ken Branch of the Cabin John Creek watershed, and the Lower Hawlings River. Only one station, located in Lower Little Seneca Creek, rated "fair/poor." This small stream was almost dry when monitored in 1998, and consequently received lower than normal habitat scores.

There were no poor scores from the final 1994 to 2000 data. These results can be compared to the habitat assessment results for each water-shed in the 1998 CSPS. conditions.askdep.com

Channel stability

In the first CSPS (1998), stream channel stability was assessed using the following four parame-ters; *embeddedness, pool sediment deposition, stream bank vegetation,* and *stream bank stabil-ity* . The same parameters were re-examined in this update with the results are shown in Figure 5B. If a station scored "fair" or "poor" on at least one of the parameters, stream habi-tat was considered unstable.

Sixty nine per cent (274) of the stations moni-tored for habitat from 1994 through 2000 exhibited unstable stream channels. There are many streams in unstable condition and they are distributed across the county. These ratings reflect the continuing impacts of the county's earlier agricultural development, followed by more severe impacts of urban and suburban development when it lacked adequate stormwa-ter controls.

When stream stability ratings were reviewed within each of the twenty three major water-sheds, large areas of Muddy Branch, Watts Branch, Cabin John, Lower Rock Creek, Middle Great Seneca, and the Northwest Branch were rated as unstable; while much of Upper Patuxent, Little Bennett Creek, Little Seneca Creek, and Upper Great Seneca Creek in the northern part of the county rated as stable. Portions of the Upper Rock Creek watershed below Lakes Needwood and Frank are stable, as well as Sligo Creek and the Upper Paint Branch.

TABLE 5A. Summary of County Stream Habitat Conditions (1994-2000)

Habitat Conditions	Stream Miles	Stream Miles Monitored (%)	Acreage	County Acreage Monitored (%)
Excellent	68	5	14,098	5
Excellent/Good	137	11	31,294	11
Good	790	62	180,192	62
Good/Fair	64	5	15,587	5
Fair	124	10	31,165	11
Fair/Poor	3	0.3	619	0.2
Poor	0	0	0	0
Habitat Data Not Available	86	7	18,046	6
Intermittent streams or streams too deep to monitor	112			
River/lake/canal systems	114			
TOTAL	**1,498**		**291,001**	

Availability of updated information on stream and habitat conditions and trends since 2000

The County has collected and analyzed available 2001 to 2003 data collected from some 180 monitoring stations since final 1994 to 2000 data results were compiled for this report. Preliminary results are compiled as an analysis of water quality trends seen since 2000 and can be reviewed or down-loaded from DEP's website. trends.askdep.com Results include maps and tables describing water quality and habitat conditions and trends found at each monitoring station along with general observations of what these data suggest, statistically, about countywide trends in water quality and habitat conditions since 2000. DEP will update preliminary and trends information periodically, as new monitoring data is collected and analyzed.

VI. Imperviousness and Streams

Impervious and highly compacted surfaces covering the landscape affect how much water infiltrates and how much runs off. Recent research (Center for Watershed Protection, 2003) has shown that most stream quality indicators will decline when watershed imperviousness exceeds ten percent, with severe impairment occurring when imperviousness exceeds 25 percent. A preliminary regression model developed by DEP, and based solely on available county stream quality and watershed impervious area data, also predicts that average aquatic insect IBIs could decline to the fair category when imperviousness exceeds eight percent. When imperviousness exceeds 21 percent, the model predicts that average aquatic insect IBIs may shift to the poor category (Figure 6A).

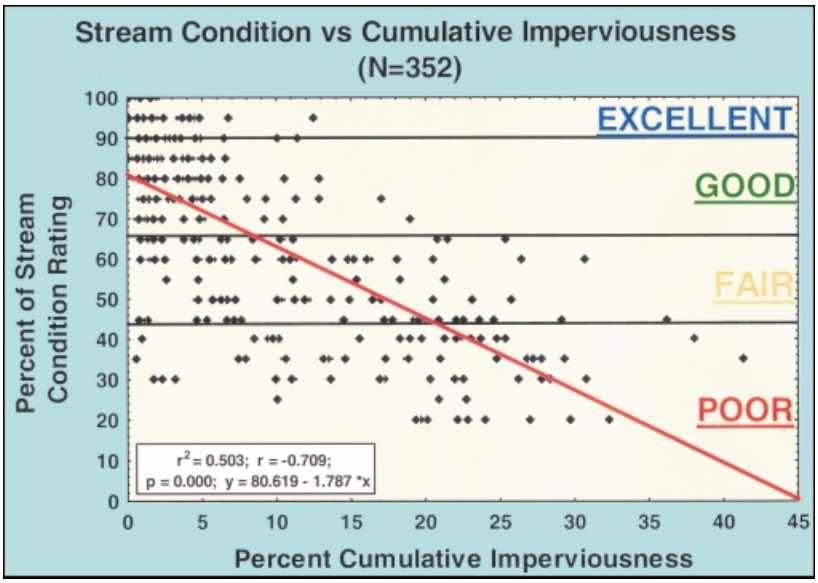
Additional research is needed to assess the extent to which the combined effect of modern stormwater controls, stream buffers, and forest reforestation, can help mitigate the effects of increasing imperviousness and compacted soil conditions in urban and suburban watersheds. For example, some studies (ERM 2000, Maxted 1999, CWP 2003) suggested a small but positive effect of stormwater control relative to aquatic insect diversity. This positive effect was seen in the five percent to 20 percent imperviousness range, but was not detected beyond 30 percent imperviousness. The Center for Watershed Protection Study (CWP 2003) further notes that it would be premature to presume that stormwater management controls are of limited value in maintaining biological diversity in small streams. Most stormwater management control structures studied to date were designed to control certain types of storms but were not specifically designed to protect stream habitat or to optimize prevention of downstream channel erosion. Forest retention and buffers may also provide benefits that have not been well quantified (CWP 2003). Few studies have actually followed a small watershed from pre-construction through to the build-out of projects to evaluate the cumulative effects of various combinations of stormwater management controls, supporting stream buffers, trees and other stormwater pollutant controls in mitigating watershed development impacts.

Next steps

DEP's stream monitoring databases are now linked to other County GIS databases on land cover and natural features. This allows analysis of relationships between water quality impacts, potential determining factors such as impervious land cover, compacted lawn surfaces, and piped drainage systems, and the effects of various types of stormwater management controls, stream buffers, and urban tree canopy in helping to mitigate these impacts. In addition, DEP has been monitoring the effectiveness of current stormwater management facilities located in designated Special Protection Areas within the Upper Paint Branch, Piney Branch, and the Clarksburg Master Plan areas of the Little Seneca Creek watershed. As more of this data becomes available, DEP hopes to be able to better quantify how redundant and modern *Best Management Practices* can help to mitigate the effects of imperviousness on the biological communities in our streams. DEP has also been a research partner with University of Maryland scientists, in developing a predictive model to examine how changes in the landscape alter stream *hydrology* , channel geometry and stream ecology.

DEP is also required to monitor the effectiveness of the new Maryland stormwater design manual in maintaining healthy stream environments. This study design includes a small test watershed in the Clarksburg area that, at authorized master plan development, will have about 30 percent of the land surface in impervious area. The study includes monitoring comparisons with a control stream in an adjoining watershed that will remain within a relatively undisturbed public park. DEP's monitoring for this work includes stream flow, groundwater levels, channel geometry, water temperature, biological community monitoring, and some water chemistry. Light Detection and Ranging photography (*LIDAR*) has also been recently flown over the area. DEP hopes to use this technology to help better measure changes in the stream channel conditions and their relationship to development activities in the watershed. Co-investigators in this study include the U.S. EPA, University of Maryland Baltimore County, Montgomery County's Department of Permitting Services, M-NCPPC, and the USGS.

FIGURE 6A.



VII. County Watershed Protection and Restoration Programs

Montgomery County employs a variety of comprehensive, interagency programs that address and help mitigate the effects that watershed development and increases in impervious area have on natural stream systems. Since 1927, a comprehensive park acquisition and subdivision review program administered by the Maryland-National Capital Park and Planning Commission (M-NCPPC) has purchased parkland or reserved conservation easements to add protective stream buffers for most of the county's watersheds now undergoing development change. These buffer areas help filter pollutants in runoff and provide habitat cover for fish and wildlife. In carrying out its land use master planning and development review responsibilities, the M-NCPPC develops resource inventories and employs strict environmental guidelines that help protect floodplain areas, wetlands, and forest resources important to water quality protection. As new development occurs, the County's Department of Permitting Services (DPS) requires a diverse array of accompanying *stormwater infiltration* g and detention controls, along with improved site planning, to help mitigate impacts of impervious area increases that on stream *hydrology* g, habitat, and resident aquatic communities. These controls capture and treat runoff to address both the peak flow quantity impacts on streams and reduce pollutants contained in the runoff.

Increasingly effective construction site sediment controls and stormwater runoff control have been in effect since the early 1970's.

Since 1990, Montgomery County's Department of Environmental Protection has been applying the Capital Improvements Program (CIP) to proactively build projects that improve runoff controls and restore degraded streams in developed watersheds. Priorities identified in the original *Countywide Stream Protection Strategy* are used to help target these watershed restoration efforts. Thus far, DEP has focused CIP project implementation primarily in older, urban areas which developed before runoff controls were required and where damages to natural stream habitat have been the greatest.

Table 7A quantifies the extent of Montgomery County's recent efforts to build stormwater retrofit projects and stream restoration projects.

DEP's stormwater retrofit projects are designed to reduce peak runoff flows and pollutant loading impacts on downstream areas from watersheds that lack adequate stormwater controls. Stream restoration projects attempt to adjust the stream channel habitat to accept changes in watershed *hydrology* g that accompany watershed development, while retaining a natural sequence of riffles and pools, as needed for the sustenance of more diverse biological communities. During stream restoration, equipment is used to regrade stream bank slopes and carefully position rocks, logs, and native woody vegetation to stabilize eroding streambanks, recreate or improve habitat for fish, aquatic insects, birds, and other wildlife, and provide shading to help maintain cool stream temperatures.

DEP's general goal for these projects is to "raise the bar" to enable degraded streams to support more diverse and vibrant biological communities. Reduction of stream channel erosion to reduce sedimentation damage to downstream areas is another important objective common to all projects. A few projects are also undertaken primarily to protect vulnerable private properties from excessive stream bank erosion.

Many of the county's stream restoration projects are carried out in stream reaches protected by stream valley parkland and conservation easements reserved by M-NCPPC. M-NCPPC and other agencies are important partners with DEP in designing and building these projects, and in providing easements or cost-share funding to help support them. Other key partners include the Maryland Department of the Environment, Maryland Department of Natural Resources, and the U.S. Army Corps of Engineers.

As Table 7A and Figure 7A indicate, DEP's recently completed watershed feasibility planning studies cover 152 square miles or approximately 30 percent of Montgomery County's developed and developing watershed drainage. Studies covering another 33 square miles are underway. These watershed studies have identified many opportunities for retrofitting stormwater controls and restoring degraded sections of damaged streams. The studies form the basis for watershed actions plans which establish goals and implementation schedules for specific projects, and further identify other activities planned to address watershed protection needs and priorities. Thus far, the County has an inventory of over 380 potential projects which address needs for new runoff controls or to restore damaged sections of stream. New, ongoing watershed studies in the Lower Paint Branch and Watts

TABLE 7A. Summary of Montgomery County DEP Watershed Restoration Projects

Project Type	Completed or Under Construction	Under Final Design
Stormwater Retrofit	2,103 Watershed Acres Protected (15 projects, $4.62 million)	2,242 Watershed Acres Protected (17 projects, $6.38 million)
Stream Restoration	11.6 Stream Miles Restored (17 projects, $4.68 million)	14.7 Stream Miles Restored (37 projects, $7.50 million)
Watershed Study	152 Square Miles, Upper Paint Branch, Northwest Branch, Rock Creek, Cabin John Creek, Hawlings River ($1.68 million)	33 Square Miles, Lower Paint Branch, Watts Branch ($0.50 million)

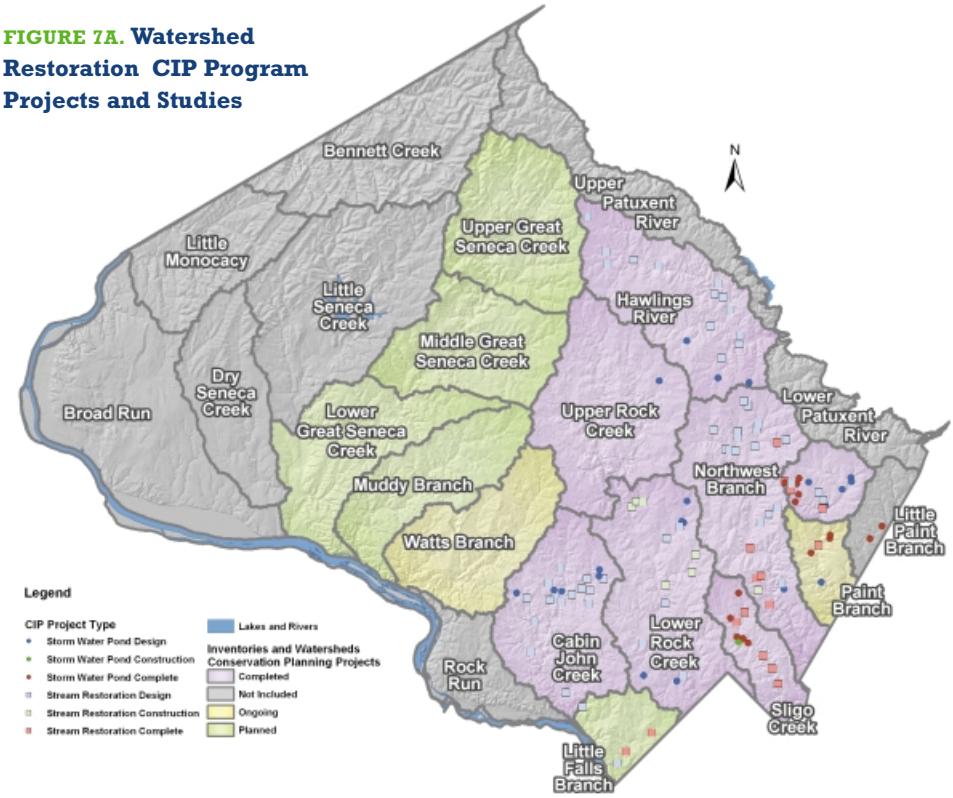
Branch are adding to this inventory. Presently, over 120 of the projects inventoried thus far have been built, are under construction, or under design. The County continues to be quite successful in securing cost-share grant funding to help support implementation of these projects and leverage the allocated County CIP funds.

This section includes pictures which show examples of projects constructed thus far. Most of these projects have been carried out with cooperation and support from M-NCPPC, and some have been in partnership with the U.S. Army Corps of Engineers and the Metropolitan Washington Council of Governments. Many projects have also received cost-share grant assistance from the state of Maryland.

To date, DEP has built, or has under final design 32 projects that add or improve stormwater management covering 4,345 acres of developed watershed drainage. Another 54 stream restoration projects have been built or are under final design to restore habitat and reduce channel erosion in 26 miles of stream. Watersheds where projects have been constructed or are presently under design or construction include Sligo Creek, Northwest Branch, Paint Branch and the Little Paint Branch of the regional Anacostia watershed, Rock Creek, Cabin John Creek, Watts Branch, Little Falls Branch, and the Hawlings River (Figure 7A). Some of the restoration projects also include the implementation of new wetlands at the end of storm drain outfalls, to mitigate water quality impacts and recreate lost habitat for frogs and salamanders.

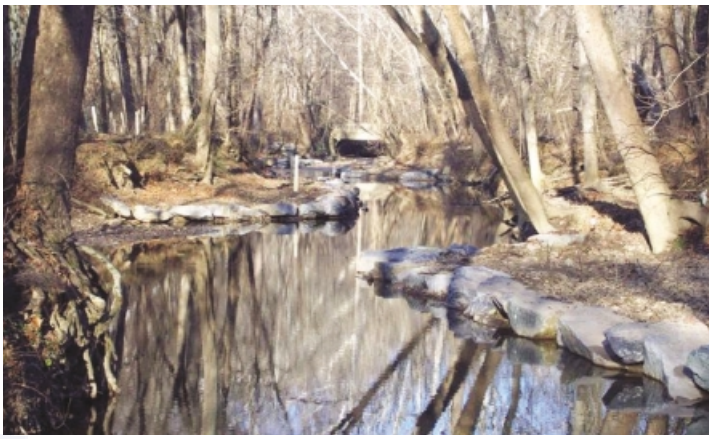
DEP's work in Sligo Creek represents the most extensive watershed restoration effort undertaken thus far in the county. Since 1990, over one dozen projects were built to add new stormwater runoff controls to 1,359 acres of upper watershed drainage and restore habitat features in five miles of stream. The Sligo Creek watershed posed special challenges, as many of the important headwater tributaries have been piped

FIGURE 7A. Watershed Restoration CIP Program Projects and Studies



and/or eliminated. When restoration began, only two fish species remained in Montgomery County's portion of Sligo Creek. Restoration progressed through at least four separate phases addressing runoff control, stream bank stabilization, and stream and wetlands habitat improvements. A team of biologists worked to reintroduce native species that once lived in the watershed. Today, 11 species (including seven species surviving from the original reintroductions) are known to be present in Sligo Creek. The diversity of the supported aquatic insect communities also improved. The next steps are to continue reintroducing formerly native species, including any lost during the 1999 and 2001 drought when parts of Sligo Creek dried up and became temporarily isolated pools. The species reintroduction plan will include more sensitive species, with the goal of raising the stream condition of the upper portions of Sligo Creek from "poor" to "fair" by the next CSPS update.

The majority of other watershed restoration projects constructed thus far have been located in the fragile headwater areas of the Upper Paint Branch watershed, where protection of the naturally propagating brown trout population is of primary concern. A number of new stormwater controls and in-stream restoration measures have been built to improve stormwater controls, restore stream habitat, add wetlands features, and address stream temperature concerns. Many more projects are planned. Stream temperature reductions achieved as a result of one project seem to be extending the quality and range of the brown trout habitat in the Upper Gum Springs Tributary. Monitoring is continuing to



Northwest Branch Restoration below Randolph Road, 2002. Before (left), overly widened shallow channel. After (right), habitat restored.

Progress in Wheaton Branch Stream Restoration. 1990 (left) devastation, 1991 (center) restoration, 2000 (right) nature's healing (showing vegetative growth seen at site of 1991 improvements).

assess the effectiveness of other individual projects as they are completed, and it will take a number of years to complete this work.

DEP and its watershed partner agencies conduct ongoing outreach programs to help educate and involve the public in the personal stewardship responsibilities critical to the success of long-term watershed protection. Interagency coordination has also improved to better integrate stream protection considerations into road design and to reduce unnecessary mowing of stream buffer areas. To help evaluate the success of stream restoration projects, interagency efforts are also underway to monitor changes in the stream channel *geomorphology* g , habitat, and supported biological communities to evaluate the success of stream restoration efforts. Some of these research efforts involve close associations with the University of Maryland College Park, University of Maryland Baltimore County, the Patuxent Wildlife Research Center, and the U. S. Environmental Protection Agency's Mid-Atlantic Integrated Assessment.

Collectively, interagency activities and projects undertaken in support of the *Countywide Stream Protection Strategy* are significantly improving habitat support for aquatic life and substantially reducing the extent of stream channel erosion that has been stimulated by uncontrolled, or inadequately controlled, stormwater runoff. The increased biological diversity that can be supported through restored stream habitat can also help supplement upland stormwater controls to uptake *nutrient loadings* g . These loadings would otherwise be delivered downstream and further stress conditions in the Potomac and Patuxent Rivers and, ultimately, the Chesapeake Bay.

Many complementary volunteer initiatives have evolved over the years which materially contribute to County agency efforts to protect and restore its watersheds. For example, the Friends of Sligo Creek and the Eyes of Paint Branch have formed as concerned, activist watershed organizations dedicated to raising community interests and involvement in protecting their neighborhood streams. These and other groups, such as the Friends of Cabin John Creek, Temple Shalom in Rock Creek, the Sidwell Friends High School in Muddy Branch, and many other schools have developed valuable website and newsletter information to raise awareness and interest about the natural features of their watersheds, related pollution management issues, and identify opportunities for direct citizen involvement in stream stewardship.

Volunteer watershed organizations help organize and implement stream-side tree plantings to add habitat and shading to streams, remove invasive plant species which overtake desirable tree and plant species in stream buffers, and stream cleanups to remove unsightly, polluting trash accumulations. Other organizations such as the Audubon Naturalist Society, Chesapeake Bay Trust, the Izaak Walton League of America, and Maryland State Save Our Streams support volunteer stream monitoring and related activities which contribute to watershed protection. DEP is also pursuing exciting new joint public/volunteer opportunities to encourage homeowners to construct small rain gardens, use rain barrels, and disconnect downspouts to storm drains. Property owners undertaking these small projects help increase on-site rainfall *infiltration* g and groundwater replenishment, conserve water for non-potable uses, and reduce off-site impacts of stormwater runoff. **see more watershed protection projects at restoration.askdep.com**

Sligo Creek — New Godwin Drive Constructed Wetland

VIII. Future CSPS Issues, Goals, and Action Items

As available funds and staffing resources allow, future efforts to implement the *Countywide Stream Protection Strategy* will focus upon the following Issues, Goals, and Action Items:

Watershed Restoration:

Issue:

The County will continue its efforts to complete watershed assessments, and to design and construct capital projects aimed at improving runoff controls and restoring habitat conditions in seriously degraded streams. The focus of these projects will continue to be primarily in CSPS priority subwatersheds, where stream erosion and sedimentation are severe and a cause of degraded stream habitat and impaired resident biological communities. For long-term, watershed restoration success, these capital project initiatives must be supported by complementary interagency and volunteer efforts to improve protection of stream buffer areas and address other manageable sources of pollution.

Goal:

Restore county streams damaged by inadequate water management practices of the past, by reestablishing the flow regime, chemistry, physical conditions, and biological diversity of natural stream systems as closely as possible

Action Items:

1. Improve the stream condition of the upper portions of Sligo Creek from "poor" to "fair" by the next CSPS update by reintroducing and successfully sustaining habitat support to more sensitive species of native fish.
2. Restore habitat conditions and abate excessive erosion in 15 miles of county streams by 2008. Monitor restoration projects to track, evaluate, and report upon success of restoration activities. Involve neighborhood citizen and watershed groups to undertake complementary tree plantings, stream cleanups, and outreach efforts that involve the surrounding communities in personal and collective stream stewardship activities critical to the long term success of watershed restoration efforts.
3. Implement stormwater retrofit and stream restoration projects to help manage or remediate impacts of uncontrolled impervious areas. By 2006, implement projects that directly control or address impacts of ten percent of impervious area drainage that has not been previously controlled to the maximum extent practicable.
4. By 2003, complete feasibility planning studies for watershed restoration on the Cabin John watershed; by 2004, on the Watts Branch watershed and the Lower Paint Branch watershed. By 2005, commence a new feasibility planning assessment on the Great Seneca Creek watershed and the Muddy Branch watershed.
5. As resources permit, work closely with Office of Economic Development (OED), the Montgomery Soil Conservation District, and pertinent local, state, federal, and agricultural agencies, to increase stream buffers in the County's Agricultural Reserve through the Conservation Reserve Enhancement Program (CREP). Seek to target the reservation of easements to establish stream buffers in those areas with needs and opportunities to improve stream habitat, temperature, and biological resource conditions.
6. Work closely with citizen groups and M-NCPPC to educate communities about the harm that encroachments cause in publicly-owned stream valley parkland and stream-side conservation easements. Unauthorized mowing, tree removal, and dumping of yard waste all impact the natural integrity and function of these areas. Collaborative efforts against encroachers should be targeted in CSPS priority subwatersheds, in Special Protection Areas, and areas where DEP is engaged in stream restoration efforts.
7. Work closely with WSSC, the Town of Poolesville, and MDE to ensure that effective inspection, maintenance, and management programs are in place to notify the public and protect county streams from wastewater overflows, leaks, or discharges from existing transmission or wastewater treatment infrastructure. Work with these agencies to assure timely establishment and maintenance of the necessary programs to fully comply with new EPA regulations addressing sanitary sewer overflows.

New Development Controls:

Issue:

Current zoning specifications, regulations, and code requirements often unintentionally and unnecessarily impede implementation of land development more sensitive to water quality and water conservation needs. An updated review of these requirements is needed to find development designs that reduce impervious area and peak runoff impacts, promote stormwater reuse, and enhance replenishment of groundwater for sustaining well yields and stream base flows.

Goal:

Explore opportunities to lessen unintended, adverse environmental impacts of land development on water resources.

Action Items:

1. Work with the M-NCPPC, DPS, and the DPWT to conduct a joint interagency assessment of current zoning, subdivision, building, and road code standards that impede efforts to mitigate the environmental effects of land development. Assemble a Task Force to initiate this effort by early 2004 and develop related recommendations by 2005.
2. Develop, by June 2005, proposed changes to Chapter 19 of the County Code and associated regulations to implement a grading ordinance provision to improve management of lot-to-lot drainage and avoid related nuisance flooding and erosion problems.

Nutrient Management Legislation:

Issue:

The banning of phosphate-based detergents was a highly successful strategy that helped to substantially reduce phosphorus inputs to the Chesapeake Bay and its tributaries. Improving the management of nitrogen continues to be a primary, but somewhat more elusive, nutrient management goal for these watersheds. Much remains to be done to control the effect of wastewater nutrient discharges combined with the effects of nitrogen laden runoff from agricultural land uses, urban and suburban lawns, and air pollutant deposition. The limited success seen thus far reflects the high costs and diminishing returns expected from more stringent wastewater effluent discharges, and the difficulties of effectively controlling diffuse runoff and air deposition sources of nitrogen. Additional steps are needed to proactively address problems of excessive nitrogen inputs, many of which are manageable only through concerted statewide and national initiatives.

Goal:

Reduce nonpoint runoff sources and air deposition sources of nitrogen impacting local streams and the Chesapeake Bay.

Action Items:

1. Consider seeking passage of State legislation to establish a user fee/charge for nitrogen-based suburban lawn and garden fertilizers, to serve as a disincentive for excessive use. Use collected funds to support a grant program for local governments to implement environmental outreach, and fund projects to control nutrient inputs to local waterways.
2. Seek National Association of Counties (NACo) support for national legislation to mandate improved controls on point source air quality discharges from utilities, and to mandate greater use of hybrid vehicles and improved engine air emissions.

Other Pollution Source Controls:

Issue:

New initiatives are needed to reduce impacts on county streams from sediments, abrasives, metals, and nutrients generated from highly trafficked urban and suburban areas. Some of these initiatives also have important cross-media environmental benefits in groundwater replenishment, temperature mitigation, and capture of air pollutants.

Goal:

Target and reduce general runoff pollution loadings from runoff draining intensively developed urban/suburban areas while also providing, in some cases, other important cross-media environmental benefits.

Action Items:

1. Propose a budget initiative to increase the range and frequency of coverage of street sweeping/vacuuming to help reduce concentrated sources of runoff pollution impacting county streams. Target highly trafficked areas with high pollutant generation and solids removal potential, and areas upstream of watershed restoration implementation projects.
2. Propose a budget initiative to implement a pilot project that installs runoff filtration devices at storm drain inlets to remove pollution from high traffic streets. Initially target areas in the Bethesda, Silver Spring, and Wheaton Central Business Districts to test and evaluate the effectiveness of alternative technologies available for this purpose.
3. By 2004, secure grant funds and implement new Low Impact Develop (LID) projects at four County facilities with high public visitation (library, health care center, recreational facility, fire station). Use these pilot installations to demonstrate the capabilities of rain gardens and other bioretention technologies to reduce runoff impacts and infiltrate rainwater to help replenish groundwater.
4. Beginning in 2003, target street tree plantings to priority subwatersheds where the addition of tree canopy may help slow down peak runoff flows, and may mitigate temperature effects of runoff traversing urban surfaces before entering natural stream environments.
5. Seek funding for an outreach effort to encourage more volunteer tree plantings to increase tree canopy in residential yards to help reduce peak stormwater runoff, capture air pollutants, and add shading to help buffer urban/suburban "heat islands." These trees create windbreaks, effect air temperatures, and reduce related energy needs and costs for heating and cooling.

Public Outreach to Increase Volunteer Stewardship in Pollution Reduction and Management:

Issue:

Efforts to educate and stimulate greater involvement of the general public and business community in volunteer stewardship initiatives continue to gain importance in efforts to have environmentally sustainable neighborhoods. DEP has engaged in extensive outreach through its past support of volunteer monitoring, streamside tree planting, and cleanup activities. DEP also disseminates varied information on environmental stewardship roles, and opportunities for citizens and businesses through its comprehensive website, fact sheets, brochures, and cable television programs. New initiatives are needed to more fully harness the power and effectiveness of volunteer citizens, environmental groups, and the business community in helping to address the County's water quality protection goals.

Goal:

Promote and support new outreach initiatives that enhance public awareness and increase citizen participation in environmental stewardship.

Action Items:

1. Target public outreach and enforcement to reduce trash generation and impacts on streams from fast food and other pertinent businesses. Educate streamside residents about the impacts of yard wastes into streams and target priority CSPS subwatersheds to eliminate illegal dumping activities.
2. Seek state legislation to include porcelainberry and kudzu with other invasive species classified as noxious weeds in current state regulations. Beginning in FY05, seek additional resources to increase outreach measures to encourage homeowner plantings of native, rather than exotic and potentially invasive, plant species. Engage volunteers to help remove invasive plants that are damaging their neighborhood streams. Focus this effort on non-park areas not already covered by the M-NCPPC's highly effective "Weed Warriors" program.
3. Continue and expand efforts to secure and implement grants that are applied to educate and support homeowners to voluntarily redirect runoff from impervious surfaces on their properties and to implement rain barrels, rain gardens, and other individual Low Impact Development technologies to encourage on-site reduction of runoff, encourage water conservation, and enhance groundwater replenishment.
4. Beginning in 2004, seek DEP involvement with the existing deer management workgroup to participate in the resolution of deer management issues affecting forest regeneration. Seek ways to increase public understanding about the need to manage excessive deer populations which are severely impairing natural regeneration of county forests and stream side buffer areas.
5. Beginning in 2004, develop and conduct surveys on citizen's attitudes about lawns and landscaping and work closely with local and state agencies to measure and track effectiveness in achieving behavioral changes of residents and businesses in reducing fertilizers, pesticides, and improving their watershed awareness.

Montgomery County Environmental Assessment:

Issue:

The County produced *Environmental Assessment 2000* based upon results in the original CSPS and a wide variety of other water resource, forest, air quality, land use, and energy indicators. Further comprehensive baseline data collection work is needed to track the diversity and abundance of a variety of resident biological communities as measures of the quality and integrity of the county's natural landscapes. The next countywide environmental assessment will attempt to comprehensively describe the health of the total environment (streams, groundwater, wetlands, and terrestrial landscape) using, as in the CSPS, comparisons to defined *reference conditions* (g) to quantify observed data results into rating of "excellent, good, fair and poor" for watershed areas inclusive of the streams, wetlands, forests, and fields within them.

Goal:

To develop and implement a comprehensive approach for assessing environmental quality that integrates information on terrestrial, wetland, and stream conditions.

Action Items:

1. Continue cooperative annual surveys with the Patuxent Wildlife Research Center to monitor and map, as another indicator of biodiversity and terrestrial habitat quality, nesting bird populations found in various county field, forest, and urban tree canopy habitats. Develop a Nesting Bird *Index of Biological Integrity* (g) by 2005 for use in future County environmental assessments.
2. Augment existing County wetland inventories by surveying and mapping the distribution of vernal pools. Work cooperatively with the M-NCPPC to develop and maintain a vernal pool registration/certification program.
3. Continue cooperative annual surveys with the Patuxent Wildlife Research Center to monitor and map the status of amphibian populations most vulnerable to wetland habitat quality or dependent on vernal pools for survival. Develop an Amphibian *Index of Biological Integrity* (g) by 2005 for use in future County environmental assessments.

Watershed Monitoring and Reporting:

Issue:

Continued collaboration is needed with interagency partners, the scientific community, and volunteers to improve understanding of causes of biological impairment, evaluate effectiveness of control measures, and better integrate available agency and volunteer monitoring activities and data.

Goal:

To continue producing an enhanced, accurate, understandable, watershed-based assessment of county stream conditions.

Action Items:

1. Reconvene the Montgomery County Biological Monitoring Workgroup to help develop a *geomorphologic* (g) approach to assess and prioritize stream stability; identify better methods to assess sources of biological impairment not found to be habitat related; finalize the County *Indexes of Biological Integrity* (g), and improve integration of state and volunteer monitoring activities and data.
2. Continue coordination and collaboration efforts with the Maryland Water Monitoring Council, pertinent Chesapeake Bay Program and Maryland Tributary Strategy committees, and jurisdictions regulated by NPDES municipal stormwater discharge permits. Use these venues to address issues and opportunities of common interest regarding the sharing, interpretation, and equitable tracking of progress on local and regional water quality program commitments.
3. Continue DEP analysis of the effectiveness of stormwater *best management practices (BMPs)* (g) in lessening the impacts of watershed imperviousness on stream habitats. Evaluate and attempt to integrate the influences of urban lawns, piped drainage systems, tree cover, and stream buffers to expand understanding of development impacts and improve the effectiveness of management measures that protect streams.

Glossary of Terms

Agricultural storm water best management practices — are policies, practices, procedures or structures implemented to mitigate the adverse environmental effects of stormwater runoff from agricultural areas on surface water quality and groundwater. Agricultural BMPs include strip cropping, terracing, contour stripping, grass waterways, animal waste structures, ponds, minimal tillage, grass and naturally vegetated filter strips, and proper nutrient application measures and rates.

Bank stability — the overall condition of stream banks. Evaluation of stability involves the determination of whether the stream banks are excessively eroded or have that potential. Signs of excessive stream bank erosion include crumbling, undercut, unvegetated banks, exposed tree roots, any extensive areas of exposed soil.

Bank vegetative protection — measures the amount of the stream bank covered by vegetation. The root systems of plants growing on stream banks help hold soil in place, thereby reducing the amount of erosion that is likely to occur.

Best management practices (BMPs) — a practice or combination of practices determined to be the most effective means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.[1]

Biotic integrity — the ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that found in relatively undisturbed natural habitats of the region. Biotic integrity is found in aquatic ecosystems in which composition, structure, and function have not been adversely impaired by human activities.

Building restriction lines — lines that restrict where building can occur on a property.

Channel alteration — large man-made scale changes in the shape of a stream channel including straightening, increasing depth, or diverting into concrete channels, often for flood control or irrigation purposes.

Channel flow status — the degree to which a channel is filled with water. Flow status will change as the channel enlarges or as flow decreases as a result of dams and other obstructions, diversions for irrigation, or drought.

Chemical stressors — a chemical entity that can induce an adverse response resulting in biological or ecological impairment.

Deer browse — under normal circumstances white-tailed deer feed mainly on the tender, new growth of trees and shrubs (woody plants), but they are known to sample, or "browse", on other food types including grasses, fruits, nuts, and mushrooms. When the population of deer in a certain area increases, the main staples of their diet may become short in supply. During this time deer will begin to browse on all edible branches from trees and shrubs, and plants that they would not normally feed on. Excessive deer browse can impede the natural regeneration of desired tree and shrub species that sustain forested stream buffers and upland forests.

Embeddedness — refers to the extent to which stream substrate (gravel, cobble, boulders and snags) is filled and/or covered with silt, sand or mud.[2]

Epifaunal substrate — the amount of niche space or hard substrates (rocks, snags) available to insects and snails. Numerous types of insect larvae attach themselves to rocks, logs, branches, or other submerged substrates. As with fish, the greater variety and number of available niches or attachment sites, the greater variety of insects in the stream.

Eutrophication — the process by which streams and other water bodies become enriched with dissolved nutrients, resulting in increased growth of algae and other microscopic plants.[1]

Fecal Coliform (bacteria) — a group of organisms common to the intestinal tracts of humans and animals. The presence of fecal Coliform bacteria in water is a broad, but often imprecise indicator of pollution and potentially dangerous bacterial contamination.[2]

Geomorphology — the science that treats the form, structure, and patterns of stream channels and land forms as affected by flowing water.

Hydrology — the science of the origins and processes of water, its properties, phenomena, and distribution as affected by nature and as modified by people.

Index of Biological (Biotic) Integrity (IBI) — a stream assessment tool that evaluates biological integrity based on characteristics of the fish and benthic assemblage at a site.[2]

Infiltration — the portion of rainfall or surface runoff that moves downward in the subsurface rock and soil.[2]

Inflow — the flow of water into a pond

Instream cover — includes the relative quantity and variety of natural structures in the stream such as fallen trees, logs, and branches, large rocks, and undercut banks, that are available for feeding, laying eggs, or refugia. A wide variety of submerged structures and rocks in the stream provide fish and aquatic insects with a large number of niches, thus increasing the supported biological diversity.

LIDAR (Light Detection and Ranging) — similar to RADAR; used for measuring heights of features, such as forest canopy height relative to the ground surface, and water depth relative to the water surface.

Non-point sources — contaminants such as sediment, nitrogen and phosphorus, hydrocarbons, heavy metals, and toxins whose sources cannot be pinpointed but rather are washed from the land surface in a diffuse manner by stormwater runoff.[2]

Nutrient concentration — the amount of nitrogen or phosphorus in a defined volume of water (such as milligrams of nitrogen per liter of water).

Nutrient loadings — the total amount of nitrogen or phosphorus entering the water during a given time, such as "tons of nitrogen per year." Nutrients may enter the water from runoff, groundwater, or the air in the form of rain or snow or dry deposition.

Reference condition — conditions (i.e. habitat, chemical, biological) that reflect least impaired or best attainable conditions in a given area.[2]

Riffle frequency — how often a reach of stream is characterized by shallow, fast moving water broken by the presence of rocks and boulders.[2]

Riparian vegetative zone (riparian buffer) — a transitional area around a stream, lake, or wetland left in a natural vegetated state to protect the waterbody from runoff pollution. Development is often restricted within such zones.[2]

Sediment deposition — sediment that has accumulated in pools. Large-scale movement of sediment may cause the formation of islands, point bars or shoals, or result in the filling of runs and pools.

Sediment concentration — the amount of sediment in a defined volume of water (such as milligrams of sediment per liter of water).

Sediment loading — the solid material transported by a stream, expressed as the dry weight of all sediment that passes a given point within a specific period of time.

Sediment loads — the total amount of sediment entering the water during a given time, such as "tons of sediment per year."

Stormdrain outfalls — the point at which a system of channels and pipes designed to carry collected rainwater discharges directly into a stream.[1]

Urban storm water best management practices — are policies, practices, procedures or structures implemented to mitigate the adverse environmental effects of uncontrolled stormwater runoff in urban or suburban areas on surface water quality and groundwater resulting from land-use. Emphasis is on controlling the quality and quantity of the runoff.

[1] From the Mountains to the Sea: The State of Maryland's Freshwater Streams. (1999). By D.M. Boward, P.F. Kazyak, S.A. Stranko, M.K. Hurd & T.P. Prochaska. EPA & Maryland DNR.

[2] Fairfax County Stream Protection Strategy Baseline Study

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DEP Mission Statement:

To protect and enhance the quality of life in our community through conservation, preservation and restoration of our environment guided by principles of science, resource management, sustainability and stewardship.

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Published in October 2003

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